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Comparisons of Some Grazed and

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COMPARISONS OF SOME GRAZED AND PROTECTED AREAS OF THE BOISE NATIONAL FOREST

A Report
Presented to the
Intermountain Forest and Range Research Station

by

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INTRODUCTION

In the early part of this century, heavy utilization of rangelands of the Boise National Forest led to deterioration of the soil, vegetation and watershed values of the area. By the 1920's, recognition of these problems was widespread and actions were taken to remedy the situation. Studies of natural revegetation processes were a primary component of these actions, laying the groundwork for the present study.

Between 1927 and 1931 six domestic livestock exclosures were constructed on lower elevation rangelands of the Boise National Forest. These areas were studied almost yearly from 1931 to 1940 and again in 1955. After 1955, funding for continuing study was not available and the project was temporarily abandoned. Thereafter, maintenance of exclosures occurred only haphazardly and several were in danger of fading into non-existence.

Rescue arrived in the form of a cooperative agreement between the University of Idaho and the Intermountain Forest and Range Experiment Station. This agreement provided that these areas be studied once again and the continuing usefulness of the exclosures evaluated.

Objectives

Two objectives guided this study. The first was to identify changes which have occurred on plots established in 1931. The second objective was to compare, where possible, areas protected from grazing for 46 years to areas which had been grazed during that period.

A thesis submitted to the University of Idaho graduate school for the Master of Science Degree (Voth 1979) considered the first objective in detail. This report will deal with the questions posed by the second objective.

LITERATURE REVIEW

Only a few studies have dealt directly with the problem of comparing changes in vegetation on protected and grazed areas over a long period of time. These studies have shown a wide variety of responses.

In 1941, Costello and Turner reported on a study of 139 sites scattered throughout a variety of vegetation types. Several general conclusions were drawn from this study: (1) Density usually increased with protection from grazing. (2) Ungrazed areas tended to have larger numbers of perennial grasses and forbs but similar amounts of shrubs as grazed areas. Additionally, certain species will respond more readily than others to protection. And, (3) little difference in forage value could be detected.

Gardner (1950) found, in contrast, that, while grass cover in protected areas of desert grassland increased, little change in floristic composition occurred.

Protection from grazing in Ponderosa pine and rough fescue sites in British Columbia resulted in increasing yields and changes in species composition (McLean and Tisdale 1970). Species which showed change varied between habitat types.

Turner (1971) found that vegetation of a salt-desert shrub community showed little response to protection which could clearly be attributed to livestock exclusion, although an increase in litter and moss cover within exclosures was attributed to the lack of trampling.

In a sagebrush-grass type, Rittenhouse et al. (1974) found results which were similar to Turner's. While five of eight species examined changed through time, responsibility for change could not be clearly assigned to protection from grazing.

In desert grassland ranges of Arizona perennial non-shrubby species showed greater improvement inside exclosures than out (Smith and Schmutz 1976). However, the shrubby component of the vegetation continued to increase regardless of the grazing treatment.

West (1978) found few significant differences between survival of plants in grazed versus ungrazed plots in salt desert shrub communities. This does not contradict Turner's findings in the same vegetation type.

Norton (1978) reported that heavy grazing did not affect the general trends in plant cover or species composition when compared to vegetation protected from grazing since 1935. Inherent plant longevity, opportunities for plant replacement and differential response to climatic patterns were cited as more significantly impacting vegetation.

Finally, Rice and Westoby (1978), after studying several Great Basin shrub communities, reported that changes with protection from grazing were slow to nonexistent and did not differ significantly from changes in grazed vegetation.

In attempting to explain the wide variety of responses discussed above, a variety of factors need to be considered. Among these are: (1) the intensity and timing of the grazing treatment, (2) the length of time vegetation has been protected, (3) the timing and intensity of climatic fluctuations, (4) the type of vegetation (long-lived versus short-lived), and (5) the environmental regime (stressful versus nurturing). The interplay of these factors might well make sense out of the somewhat confusing array of responses reported.

STUDY AREA DESCRIPTION AND METHODS

A comprehensive description of the study area as well as a description of the methods of data collection were included in the thesis mentioned earlier. Methods of data analysis were described in the same paper. Because of differences in objectives for the two reports, however, some additional comments need to be made.

Summarization of data and classification of plots were carried out as described in the thesis. And, as was true in the examination of changes through time, plots were ordinated and trajectories of these plots traced through time for each plot group identified in the classification.

Within each polar ordination protected and grazed plots were identified. Then, patterns formed by each of these kinds of plots were compared. Patterns resulting either from different plots within a given year or from different plots through the years were examined. Species foliar cover by site matrices were examined to clarify the basis for the ordination.

Following examination of plots within ordinations, several other plot group characteristics were examined. Average foliar cover values, expressed as percent of plot, average number of species per plot and average ground cover were all examined. Each of these parameters were calculated for both grazed and ungrazed plots through time in each plot group. Average ground cover values were estimated in three classes: vegetation, litter and bare ground.

Visual impressions from exclosure areas were noted and used to clarify information gained through data analysis.

Problems in Data Analysis

A multitude of problems limited the sensitivity of data analysis. The first of these problems was the lack of a statistically valid sample. Both exclosures and the associated permanent plots were arbitrarily rather than randomly chosen. Exclosures were not replicated and permanent plots were inadequately replicated. Finally, plots were not originally paired across treatments. Some pairing was attempted later in the study's life but, since the initial condition of plots was not adequately described, this pairing was not reliable. Even if site characteristics were similar, the possibility of initial differences in disturbance invalidated the pairing. The problems associated with unpaired plots were compounded by the problems resulting from unequal numbers of samples. Frequently, the number of plots established inside an exclosure had no decipherable relationship to the number of plots established on grazed areas.

As a consequence of these problems in sampling, it was determined that statistical tests of significant difference were not appropriate. Instead, descriptive techniques such as polar ordination and trend identification were employed.

A second major problem related to the paucity of historical information about exclosure areas. Histories of use, as indicated earlier, were incomplete. Patterns of grazing use outside of exclosures varied through time and, even if numbers of animals using an allotment were known, it was often impossible to estimate reliably the amount of use a specific area received. Additionally, histories of use varied between exclosures through the years invalidating comparisons of vegetation change between exclosures.

Finally, it must be noted that the maintenance of certain exclosures was less than adequate at times. It was reported, for example, that Elk Creek Exclosure, which was constructed with a gate, was upon at least one

occasion used as a temporary holding corral for sheep. The Lester Creek Exclosure fence, by 1977, was almost entirely defunct, although verbal reports indicated that the fence had been functional several years earlier when cattle had been grazing the area. Happily for the study, the Lester Creek area had received non-use for several years prior to 1977 during the time the fence was down.

Results presented in following parts of this paper must, in view of these problems, be regarded as highly tentative. Suggestions for futher and more rewarding avenues of investigation may be the most valuable contribution of these investigations.

RESULTS

Validity of Comparisons

The Cow Creek North plot group, consisting of three plots, afforded little opportunity for a revealing comparison. Two plots were located in grazed areas and the third was within the exclosure. Plot 4 and plot 8 appeared to be similar in site characteristics but plot 9, one of the two outside plots, was unique in that it supported, from 1931 to 1977, a much stronger shrub component than either of the other two plots.

In the Cow Creek South plot group, four plots were located within the exclosure and three were in grazed areas. One of the four protected plots, plot 2A, could not be considered in comparisons of treatment differences because, in 1931, it was the site of an ant pile and was largely denuded. In ordinations, plot 5 also appeared to be different from both other grazed and protected plots. Its usefulness as a basis for comparison is questionable.

The Cow Creek area, after having burned in 1945, was seeded by plane with several introduced species. This disturbance generally limits the validity of any comparisons.

Two plots were located on south slopes of the Wood Creek area. One was protected; one was grazed. These plots were apparently a legitimate pair but the existence of only one plot per treatment was unfortunate.

Eight plots were located on less harsh aspects of the Wood Creek area. Four were protected and four were in grazed areas. These plots, being the exception, were paired upon establishment, and the pairing would appear to have been substantiated by time.

In the Lower Bell Mare plot group, seven plots were protected and four were grazed. Three of the seven protected plots were established in

1935, four years later than the establishment of the eight initial plots. These eight plots were themselves established three years after construction of the exclosure fences.

Only three plots were included in the Elk Creek South plot group. Of these, two were similar in site characteristics, but the third, one of two protected plots, was in a much more level, lowland area. Again, the existence of so few plots afforded little opportunity for comparison.

Two of the nine Elk Creek Northwest plots were located outside of the exclosure area. While one of these two plots seemed comparable to the protected plots in site characteristics, the other was steeper and rockier. Again, conclusions based on the comparison of protected and grazed plots could only be weakly supported.

Upper Bell Mare East plots, of which there were six, presented almost identical problems. There were six plots in this group, only one of which lay in the grazed area.

Lester Creek plots, of which there are eight, formed two groups, one of which contained upper slope plots with only a small shrub component, the other of which contained lower slope, much more shrubby plots. In each group there were four plots, two of which were grazed and two of which were protected. The very small sample size was the major problem of this group.

Polar Ordinations

Among the polar ordinations of plots, only two, the Elk Creek Northwest (Fig. 1) and the Lester Creek (Fig. 2) ordinations, showed any noticeable difference between the patterns of grazed and ungrazed plots. This difference was, however, very slight.

Plot 10 of Elk Creek Northwest remained through all years of the study much like the early years of protected plots. Foliar cover values

of Poa sandbergii remained high and cover values of other species remained low. This may, however, have been attributable to a difference in site factors as easily as to a difference in grazing treatment. Plot 10, as mentioned earlier, was on a steeper and more rocky slope than most other plots. Plot 11, while separated from protected plots in earlier years by a small amount, merged with those plots in 1977 within the ordination. Differences here were too slight to allow for valid interpretation.

In the Lester Creek plot group, the major difference lay between protected plots 1 and 2 and grazed plots 5 and 6. Again, this difference seemed to reflect environmental differences rather than treatment differences. Symphoricarpos oreophilus, Artemisia vaseyana and Lathyrus pauciflorus occured primarily in plots 5 and 6. Delphinium menziesii, Eriogonum umbellatum and Purshia tridentata, on the other hand, were found primarily on plots 1 and 2.

Ground Cover, Foliar Cover, and Numbers of Species

Neither average ground cover estimates (Table 1) nor average foliar cover estimates (Table 2) revealed strong distinctions between grazed and protected plots. Due to the difficulties of sampling, only blatant differences would have been interpretable and these did not appear to exist.

The same apparent similarity between grazed and protected plots was noteworthy in an examination of average numbers of species on a plot (Table 3).

DISCUSSION

Current information did not allow the identification of any difference between grazed and protected plots in any of the plot groups. While the vegetation of these plots has changed through time (Voth 1979), the patterns of change following exclusion of livestock did not noticeably differ from the patterns of change occurring in vegetation which experienced moderated but continued grazing.

This failure to show a difference does not necessarily mean that no difference existed. A more adequate survey designed to show statistically significant differences would be more sensitive to differences. Estimates of production and or plant density or frequency made in vegetation stratified for homogeneity would be of interest.

If it is assumed that there is indeed no difference between grazed and protected areas, what implications does this have for management? First, the moderate levels of grazing instituted in the latter part of the study may be well below the tolerances of most species and so acting in the same way as protection. It is also possible that some slight advantage gained from the trampling of seed into the ground compensated for the stress of defoliation due to grazing, thus effectively acting in the same way as protection. A third possibility is that inadequate time for the manifestation of the impacts of protection elapsed.

Both the exclosures and permanent plots associated with these exclosures remain valuable despite the lack of a shown difference in this study. If the lack of difference between treatments is authentic, the Forest Service's management of the area is validated. Continued observation of the exclosures will lend further strength to justification of management

plans for the area. Protection of these exclosure areas will allow the continued existence of a standard against which management may be evaluated. Although techniques of sampling employed for this report were inadequate for evaluation of differences between grazed and protected plots, other techniques, if exclosures remain available, could prove useful.

Permanent plots, while not overwhelmingly useful in the evaluation of differences between grazed and protected plots, were of value in examining successional patterns. Their value in this endeavor will increase with time simply because so few other areas with similarly long histories exist.

Studies focusing on plant demography have only been lightly brushed over in this report and in the previous thesis. Much remains which could be done with the data from the permanent plots in this respect. This topic, largely ignored in the area of range research, will become increasingly more important if our knowledge of ecological relationships on rangelands is to grow.

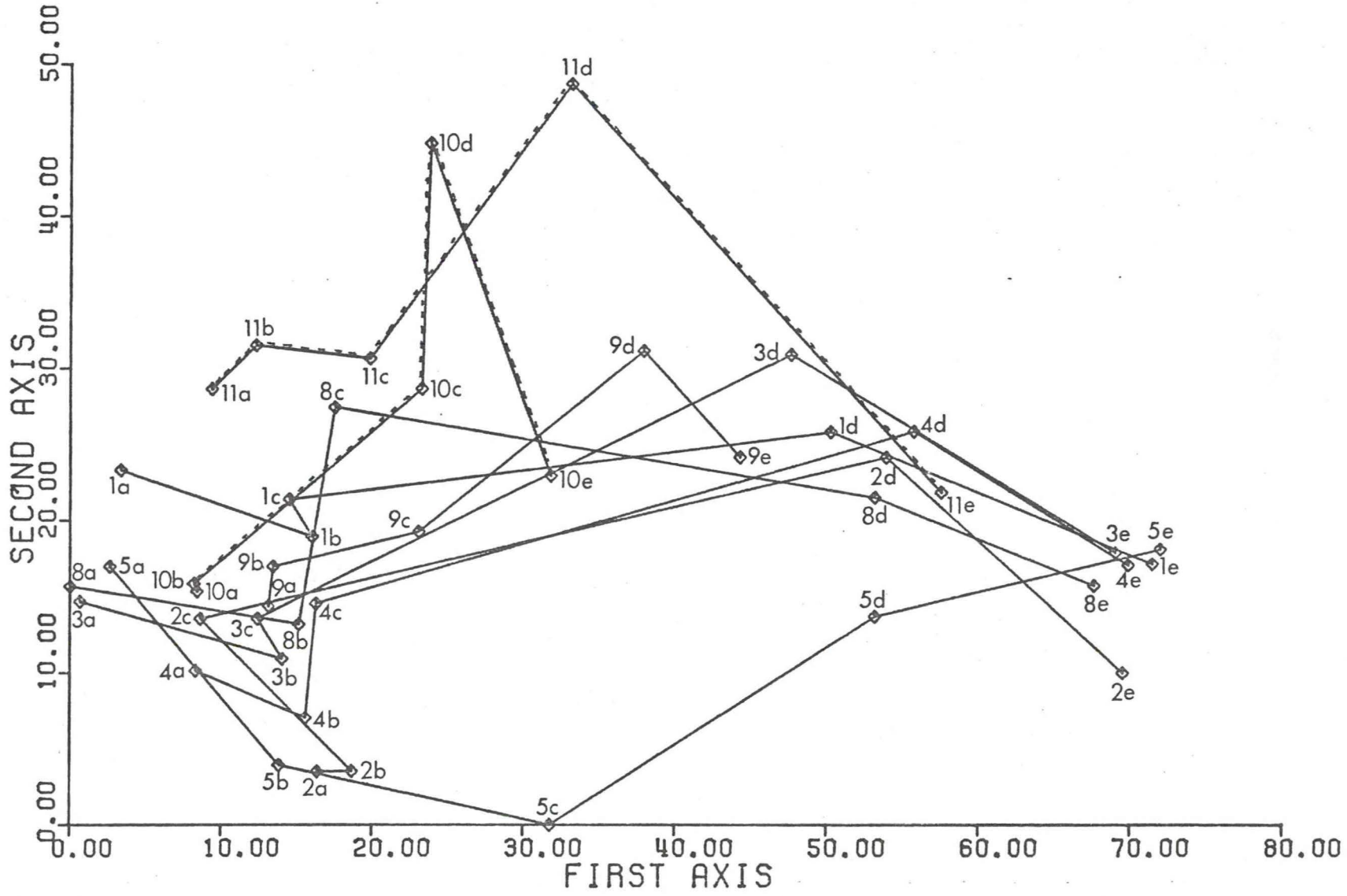

Fig. 1. Polar ordination of Elk Creek Northwest plots through time using transformed (log 10(x+1)) species foliar cover values. A=1931, b=1934, c=1940, d=1955 and e=1977. Plots 10 and 11 were protected; all others were grazed.

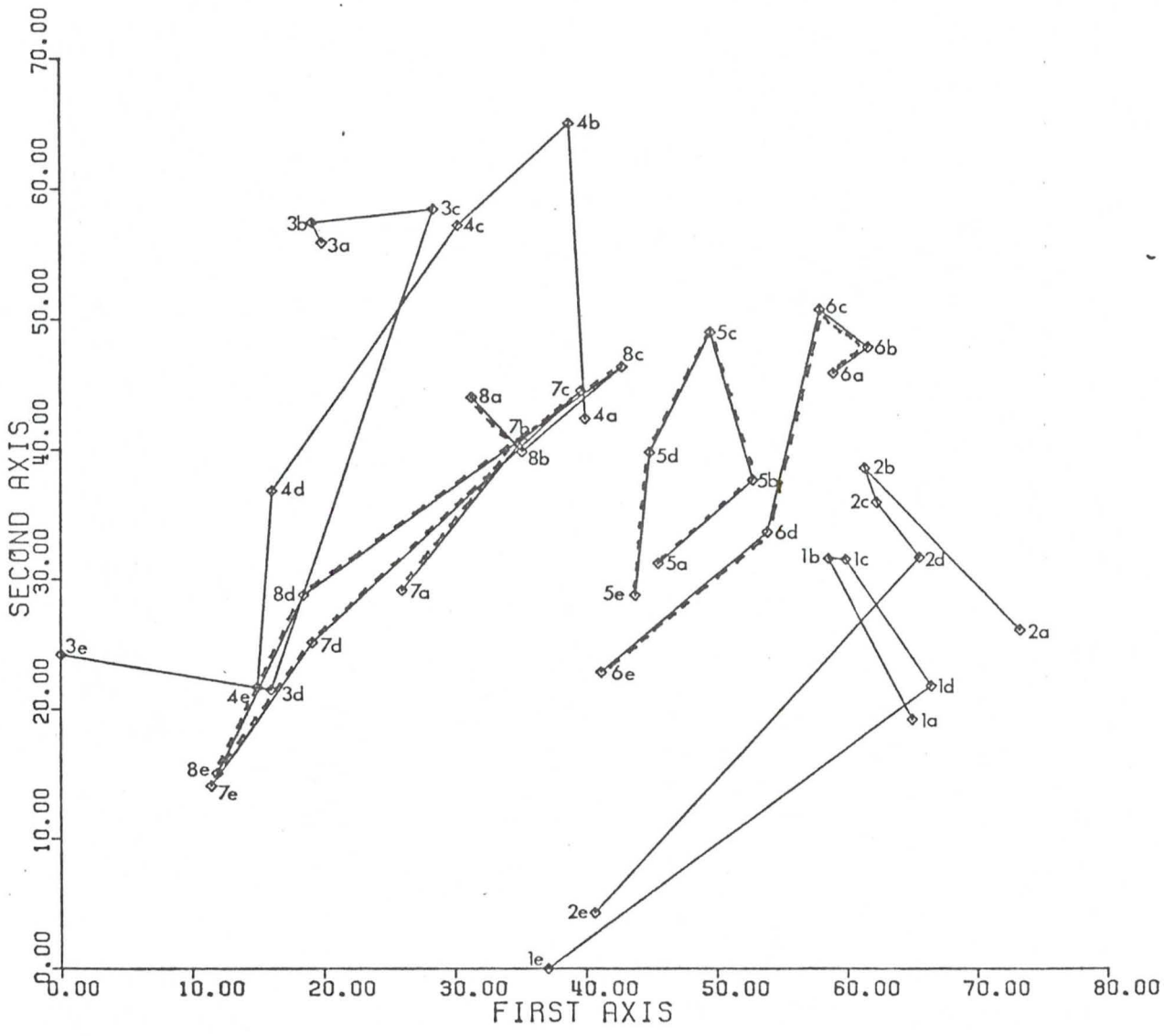

Fig. 2. Polar ordination of Lester Creek plots through time using transformed (log 10(x+1)) species foliar cover values. A=1931, b=1934, c=1940, d=1955 and e=1977. Plots 1-4 were protected; plots 5-8 were grazed.

Table 1. Average percent ground cover of grazed and protected plots within plot groups as estimated in 1977.

Plot Group	Ground Cover		
	Vegetation	Litter	Bare Ground
	%		
Cow Creek North			
grazed	40	50	11
protected	71	29	0
Cow Creek South			
grazed	36	44	17
protected	23	54	23
Wood Creek South			
grazed	22	45	33
protected	20	48	32
Wood Creek			
grazed	19	25	55
protected	15	21	65
Lower Bell Mare			
grazed	35	31	32
protected	28	38	36
Upper Bell Mare East			
grazed	44	26	30
protected	39	28	34
Upper Bell Mare Misc.	No Comparisons Possible		
Elk Creek South			
grazed	18	26	56
protected	23	37	40
Elk Creek Northwest			
grazed	30	33	36
protected	24	23	52
Lester Creek			
grazed	48	24	29
protected	38	20	39

Table 2. Average percent foliar cover by life form for grazed and protected plots within plot groups as estimated in each of five years. P = protected; G = grazed.

Life form within Plot Group	Foliar Cover									
	1931		1934		1940		1955		1977	
	P	G	P	G	P	G	P	G	P	G
Wood Creek										
Perennial Grasses	.2	.4	.3	.2	.5	1.0	5.4	5.9	4.6	3.3
Perennial Forbs	1.0	1.1	.9	1.1	.7	.9	4.2	3.4	6.4	4.7
Shrubs	.4	.4	----	----	----	.1	.1	.1	.1	1.3
Biennials	.1	.1	.1	.3	----	.1	----	.2	.7	.3
Annual Grasses	4.9	3.9	.1	.1	.1	.1	.2	.1	.1	.1
Annual Forbs	.4	.5	.4	.3	.8	3.1	.5	2.4	2.1	.9
Total Perennials	1.4	1.8	1.2	1.3	1.2	2.0	9.7	9.5	11.1	9.2
Total	6.8	6.3	1.8	2.0	2.1	5.3	10.6	12.2	14.0	10.4
Lower Bell Mare										
Perennial Grasses	.8	.5	.9	.4	.5	.6	3.1	1.6	5.8	3.9
Perennial Forbs	1.4	2.1	2.4	1.6	1.1	1.2	2.5	5.0	3.0	8.1
Shrubs	2.8	2.7	3.5	1.0	2.7	1.7	3.9	7.5	5.4	9.4
Biennials	.3	.1	.6	.2	.2	----	1.5	1.0	1.3	.7
Annual Grasses	1.8	2.4	1.1	.1	.6	5.0	.2	.2	4.5	1.8
Annual Forbs	.2	.1	.5	.3	1.8	1.3	3.5	1.0	1.0	.5
Total Perennials	4.4	5.3	6.8	3.0	4.4	3.5	9.4	14.2	14.2	21.3
Total	7.0	8.3	7.7	3.5	6.7	9.8	12.7	16.5	20.5	24.2

Table 2 Cont'd.

Life form within Plot Group	Foliar Cover									
	1931		1934		1940		1955		1977	
	P	G	P	G	P	G	P	G	P	G
Lester Creek										
Perennial Grasses	1.5	2.0	.9	.9	1.0	.6	.9	1:4	3.8	6.3
Perennial Forbs	3.9	5.5	1.9	3.9	2.2	3.1	5.2	10.8	4.4	8.3
Shrubs	3.6	3.9	2.2	1.9	1.7	1.3	8.9	7.7	12.3	9.3
Biennials	----	.1	.1	----	----	----	.1	.1	.3	.1
Annual Grasses	----	----	----	----	----	----	----	----	----	----
Annual Forbs	.4	.4	.2	.2	.4	.4	.6	.7	.2	.1
Total Perennials	8.9	11.4	4.9	6.7	4.9	5.0	14.9	20.1	20.6	23.9
Total	9.3	11.9	5.8	6.8	13.7	5.4	15.8	20.9	21.1	24.1
Wood Creek South										
Perennial Grasses	----	----	.2	----	.2	----	.7	----	.8	.1
Perennial Forbs	.2	.2	.2	.1	.3	.1	.9	----	.5	----
Shrubs	----	----	----	----	----	----	----	----	----	----
Biennials	.1	----	----	----	----	----	.1	----	.3	.1
Annual Grasses	10.2	9.2	.1	.5	.1	.1	20.4	14.3	5.0	.4
Annual Forbs	.3	4.4	.4	.2	.7	2.1	1.2	7.5	23.1	25.1
Total Perennials	.2	.2	.4	.1	.5	.1	1.6	----	1.3	.2
Total	10.8	13.8	.9	.8	1.3	2.3	23.3	21.8	29.7	25.7

Table 2 Cont'd.

Life form within Plot Group	Foliar Cover									
	1931		1934		1940		1955		1977	
	P	G	P	G	P	G	P	G	P	G
Upper Bell Mare East										
Perennial Grasses	2.9	1.0	3.5	1.3	3.8	2.3	2.2	3.5	4.9	6.5
Perennial Forbs	1.6	1.1	3.0	3.6	2.2	3.0	10.7	10.5	15.6	19.9
Shrubs	----	----	.3	----	----	----	1.6	.1	1.5	----
Biennials	.1	.2	.2	.3	.1	.8	.3	.5	.1	.2
Annual Grasses	.3	.8	.1	.1	.5	1.1	.2	.1	.1	.1
Annual Forbs	1.6	.4	.4	.2	1.3	1.4	.4	.4	.3	.6
Total Perennials	5.7	2.1	5.4	4.9	6.1	5.3	14.5	14.1	22.0	26.4
Total	6.4	3.5	7.5	5.5	8.0	8.6	15.4	15.1	28.1	27.3
Elk Creek Northwest										
Perennial Grasses	2.1	2.0	1.9	1.7	3.3	2.9	3.2	2.8	12.4	11.0
Perennial Forbs	5.6	2.8	4.1	2.9	4.8	2.4	7.9	5.1	16.4	14.9
Shrubs	----	.1	----	.1	----	.1	----	.3	----	.3
Biennials	.1	----	----	.1	----	----	.1	.1	.1	.1
Annual Grasses	.3	.3	----	----	----	----	----	----	----	.1
Annual Forbs	.2	.3	.1	.1	1.0	1.5	.5	.5	.4	.6
Total Perennials	7.7	4.7	5.8	4.0	8.1	3.8	11.1	6.7	30.2	21.4
Total	8.3	5.3	6.1	4.2	9.1	5.3	11.7	7.3	30.7	22.1

Table 2 Cont'd.

Life form within Plot Group	Foliar Cover									
	1931		1934		1940		1955		1977	
	P	G	P	G	P	G	P	G	P	G
Cow Creek North										
Perennial Grasses	5.1	5.5	5.3	4.2	6.2	14.9	6.4	6.8	9.0	4.6
Perennial Forbs	1.8	2.3	1.1	1.1	.6	1.7	5.2	5.6	3.0	3.4
Shrubs	7.2	6.1	6.7	4.9	9.0	10.3	18.3	11.1	5.1	9.9
Biennials	----	----	.1	.1	----	----	----	.1	.1	.2
Annual Grasses	----	6.8	----	----	.1	.1	----	.1	----	.1
Annual Forbs	.5	.4	----	.1	.1	.3	----	.5	.2	.1
Total Perennials	13.8	14.1	10.9	13.1	27.1	15.8	23.4	29.9	17.7	17.1
Total	21.1	14.6	11.0	13.2	27.4	16.0	24.0	29.9	18.1	17.4
Elk Creek South										
Perennial Grasses	.4	.1	1.0	.1	1.7	.2	3.0	.2	4.2	2.3
Perennial Forbs	.8	.4	.7	.2	.5	.3	5.9	.2	5.9	1.1
Shrubs	----	----	----	----	----	----	----	----	----	----
Biennials	----	----	----	----	----	----	.1	.1	.8	.3
Annual Grasses	.8	12.5	.1	.1	.1	----	.4	4.9	.2	.2
Annual Forbs	.8	.2	1.1	.2	5.7	5.7	5.5	4.9	11.4	7.8
Total Perennials	1.2	.5	1.7	.3	2.7	.5	8.9	.4	9.5	3.4
Total	2.8	13.2	2.8	.6	7.9	6.2	12.0	10.3	22.4	11.7

Table 2 Cont'd.

Life form within Plot Group	Foliar Cover									
	1931		1934		1940		1955		1977	
	P	G	P	G	P	G	P	G	P	G
Cow Creek South										
Perennial Grasses	.6	.9	.9	.7	1.4	2.6	3.6	3:3	3.1	1.7
Perennial Forbs	1.0	2.2	.5	.5	.4	.4	.7	.4	1.2	2.9
Shrubs	5.7	7.5	5.3	6.3	5.7	7.1	12.4	15.8	11.0	15.6
Biennials	.1	----	----	----	----	----	.1	.1	.2	.1
Annual Grasses	5.3	2.9	.3	.1	22.3	3.0	7.4	2.1	1.0	.3
Annual Forbs	.2	.6	.1	.1	----	.3	.7	.9	.2	----
Total Perennials	7.4	10.8	6.7	7.5	7.5	10.1	16.7	18.4	15.3	20.2
Total	13.0	13.7	7.2	7.8	29.9	13.4	25.0	21.5	16.6	20.6

Table 3. Average number of species by life form for grazed and protected plots within plot groups as estimated for each of five years. P = protected; G = grazed.

Life form within Plot Group	Number of Species									
	1931		1934		1940		1955		1977	
	P	G	P	G	P	G	P	G	P	G
Lester Creek										
Grasses	2.0	2.3	1.5	2.5	2.0	2.3	1.8	2.8	1.5	2.5
Forbs	5.8	5.3	4.3	5.0	4.3	5.5	6.5	7.3	4.3	5.8
Shrubs	2.8	3.3	3.0	2.8	3.3	3.3	3.5	3.8	3.5	4.0
Biennials	.3	.3	.5	.3	.3	.3	1.3	.5	1.0	.5
Cow Creek South										
Grasses	2.3	2.3	2.3	2.3	2.0	2.3	2.3	1.7	2.0	2.0
Forbs	2.3	4.3	2.3	3.3	1.7	2.3	2.7	2.3	3.0	3.0
Shrubs	1.0	1.7	1.0	1.7	1.3	2.0	1.3	2.0	2.0	2.0
Biennials	.3	----	.3	.3	----	.3	1.3	.7	1.3	1.0
Cow Creek North										
Grasses	4.0	3.5	4.0	3.5	4.0	3.5	4.0	3.5	4.0	3.0
Forbs	3.0	4.5	3.0	3.0	3.0	2.5	3.0	3.0	4.0	5.5
Shrubs	2.0	3.0	2.0	2.5	2.0	3.0	2.0	3.5	2.0	2.5
Biennials	----	----	1.0	.5	----	----	----	----	1.0	1.5

Table 3 Cont'd.

Life form within Plot Group	Number of Species									
	1931		1934		1940		1955		1977	
	P	G	P	G	P	G	P	G	P	G
Elk Creek South										
Grasses	1.0	1.0	1.5	1.0	2.0	1.0	3.0	2.0	3.5	3.0
Forbs	2.5	3.0	2.5	2.0	2.0	3.0	3.0	2.0	3.5	4.0
Shrubs	----	----	----	----	----	----	----	----	----	----
Biennials	----	----	----	----	----	----	.5	----	1.0	1.0
Wood Creek South										
Grasses	----	----	2.0	----	2.0	----	2.0	----	1.0	1.0
Forbs	1.0	----	2.0	----	3.0	----	3.0	----	3.0	----
Shrubs	----	----	----	----	----	----	----	----	----	----
Biennials	1.0	----	----	----	----	----	1.0	----	1.0	1.0
Wood Creek										
Grasses	1.8	2.0	2.0	2.0	1.8	2.0	2.0	2.3	2.0	2.5
Forbs	4.3	4.3	3.0	3.8	4.0	2.3	7.3	5.3	6.3	5.3
Shrubs	.5	.8	----	----	----	.5	.5	.5	1.3	1.0
Biennials	1.0	1.0	1.3	.5	.3	.5	2.5	1.8	1.8	2.0

Table 3 Cont'd.

Life form within Plot Group	Number of Species									
	1931		1934		1940		1955		1977	
	P	G	P	G	P	G	P	G	P	G
Upper Bell Mare										
Grasses	3.0	3.0	3.0	3.0	3.0	3.0	2.8	3.0	2.6	3.0
Forbs	5.3	5.0	2.6	2.0	3.2	2.0	6.6	6.0	5.2	4.0
Shrubs	----	----	.4	----	.4	----	.4	1.0	.6	----
Biennials	1.0	2.0	2.0	3.0	1.2	----	3.4	5.0	1.2	2.0
Lower Bell Mare										
Grasses	2.5	3.0	2.6	2.3	2.3	2.5	2.1	2.3	2.1	2.3
Forbs	6.8	5.8	5.3	3.8	3.7	3.8	4.3	4.5	4.4	5.0
Shrubs	.5	.8	.6	.8	.6	.8	1.0	1.5	1.1	1.8
Biennials	1.3	.8	2.8	1.3	1.0	----	3.3	2.3	4.8	2.5
Elk Creek Northwest										
Grasses	2.7	3.0	3.3	3.0	3.7	3.0	3.4	3.0	3.4	3.0
Forbs	6.1	7.5	5.6	7.0	7.3	5.5	7.0	9.0	10.6	12.5
Shrubs	.1	.5	----	.5	.1	.5	.3	.5	----	.5
Biennials	.7	----	.3	.5	----	----	.6	.5	1.0	1.0

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